

**PHYTOTOXICOLOGY MOSS BAG
ASSESSMENT SURVEY
IN THE VICINITY OF
UNIVERSAL TERMINAL LTD.
MATILDA TWP.
SEPTEMBER 1989 THROUGH
APRIL 1990**

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**Phytotoxicology Moss Bag Assessment Survey
in the Vicinity of Universal Terminal Ltd., Matilda Twp.
- September 1989 through April 1990**

BACKGROUND

Since 1985, four separate moss bag surveys have been conducted in the vicinity of the Universal Terminal Ltd. (UTL) salt storage pad in Matilda Township near Iroquois, Ontario. The most recent survey was conducted from fall through winter during 1989/1990. The surveys were conducted to determine the status of salt emissions associated with the off-loading of salt from boats and salt pile removal operations at UTL. Previous moss bag surveys (reports ARB-152-86-Phyto; ARB-158-87-Phyto; ARB-163-88-Phyto) indicated that the off-loading activities at UTL in the fall, and the salt pile removal operations (truck loading, truck traffic) through fall and winter, can result in significant off-site contamination. The previous data further indicated that the deicing salt applications to Lakeshore Drive during the winter also can be a significant salt source. The surveys were requested by MOE staff, Cornwall.

1989-1990 MOSS BAG SURVEY

Moss bags consist of laboratory-prepared sphagnum moss wrapped in a polypropylene mesh bag. They are used as biomonitoring sources because they trap and retain airborne contaminants.

On September 19, 1989, single moss bags were placed at a height of about 3 meters at 8 regular stations established in previous years. Sites 2, 5, 8, 11 and 13 were situated on the road allowance, while Sites 9, 10 and 12 were located on residential properties more remote from Lakeshore Drive. The sites were situated at increasing distances to the west and east of the UTL salt storage pad (see attached Figure 2).

The bags were exchanged at two week intervals through to April 1990 by Cornwall MOE staff. Following exchange, the moss bags were inserted in separate paper bags and were stored at the Cornwall MOE office until delivery by Purolator to the Phytotoxicology Section, 880 Bay St., Toronto. They were received by R. Emerson who submitted them for processing to the Phytotoxicology Laboratory. Here, the sphagnum moss was removed from each mesh bag and was air dried, ground and stored in glass bottles. The moss samples were then submitted to the MOE Laboratory Services Branch, Resources Rd., Toronto, for analysis of sodium (Na) and chloride (Cl).

OTHER RELEVANT INFORMATION

As indicated in the attached documentation (MOE memorandum: Taylor to Emerson August 21, 1990), five boat shipments of salt were unloaded on UTL's asphalt salt storage pad between September 26 and November 3, 1989. The salt inventory was removed from the UTL property, using tractor trailer trucks and a large front-end loader, between September 26, 1989 and April 30, 1990. Also shown are the dates on which deicing salt was applied to Lakeshore Drive. The deicing salt applications to the road did not start until almost two weeks after the final (boat) shipment was off-loaded at UTL.

ANALYTICAL RESULTS

The moss bag chemical analysis results are summarized in the attached table. The results for the boat unloading period (Sept. 19 - Nov. 3, 1989) revealed that three of the four moss bag exposures

had elevated concentrations of Cl and Na at sites in the immediate vicinity of the UTL salt storage pad. The highest concentrations were detected during the initial exposure at Site 2 (Cl 17000 ppm; Na 13000 ppm) to the immediate east of UTL. The next highest levels were detected during the third exposure at Site 12 (Cl 6300 ppm; Na 7300 ppm) to the immediate west-southwest. The highest concentrations of Cl and Na (Site 2) were 141 and 67 times higher than the corresponding means for remote Sites 8, 11 and 13 (120 & 190 ppm). Because only lower Cl and Na levels were found at the remote sites, the elevated levels found in the close proximity to UTL were considered to be related to operations at UTL. Further, the fact that salt levels at sites closest to UTL declined immediately following the boat unloading period indicates that the boat off-loading operations were likely the primary source of the off-site contamination.

Some exposures following the salt unloading period also revealed a pattern of generally higher salt levels at sites close to UTL, particularly the exposure period from Jan. 23 to Feb. 6, 1990. During this exposure, Cl concentrations were high at Sites 9 and 10 to the east, especially Site 9 (Cl 52000 ppm). However, this level may be anomalous because it is very much out of context relative to the other Cl results for the same exposure period. It is also the highest Cl level ever detected in the survey area. Nevertheless, the fact that the Cl level at neighbouring Site 10 (3400 ppm) also was elevated during the same exposure, suggests that UTL operations (e.g. truck loading operations) had contributed to the elevation.

During November 14, 1989 through March 6, 1990, salt concentrations in moss were elevated at most sites including sites more remote from UTL. This implicates the deicing salt applications to Lakeshore Drive as an additional local source of salt contamination. During the exposure from March 6 to 20, no deicing salt was applied to Lakeshore Drive and salt concentrations in the moss bags sharply declined. This further substantiates road salting contributions to the elevated Cl and Na levels which were found throughout the survey area during the late fall and winter.

The attached bar graph (Figure 1) compares the mean Na concentration for all sites close to UTL to that for remote Sites 8, 11 and 13 for both the boat off-loading period and for the salt pile removal period during which deicing salt was applied to Lakeshore Drive. This figure further implicates the boat off-loading at UTL as being responsible for the elevated moss bag salt concentrations found during the early part of the study period. It also illustrates that the elevation found after the boat unloading period was largely related to the winter deicing salt applications to Lakeshore Road.

Several of the highest Cl and Na concentrations found during this survey were the highest to be detected since the initial 1985 survey. The highest levels detected in previous surveys were 4400 ppm Cl and 2600 ppm Na.

SUMMARY

The results of the 1989/90 moss bag survey concluded that salt emissions from the boat off-loading and, to a lesser extent, salt pile removal operations at UTL can result in significant off-site contamination. The deicing salt applications to Lakeshore Drive during the late fall and winter also were found to be a significant salt source. The Cl and Na concentrations detected in 1989/1990 were the highest since the UTL moss bag survey began in 1985.

LITERATURE CITED

Phytotoxicology Investigations in the Vicinity of the Universal Terminal Ltd. (UTL) Salt Storage Pad, Iroquois - 1984 & 1985 (ARB-152-86-Phyto)

Phytotoxicology Moss Bag Assessment Survey in the Vicinity of Universal Terminal Ltd., Iroquois - September, 1986 through April, 1987 (ARB-158-87-Phyto)

Phytotoxicology Moss Bag Assessment Survey in the Vicinity of Universal Terminal Ltd., Iroquois - October 1987 through February 1988 (ARB-163-88-Phyto)

Moss Bag Concentrations of Chloride and Sodium Detected in the UTL Survey Area
- Sept. 19, 1989 Through Apr. 3, 1990

| Exposure Period | Sites West of UTL | | | | Sites East of UTL | | | |
|---|-------------------|--------------|--------------|-------------|-------------------|-------------|--------------|--------------|
| | 5 150 m* | 12 150 m | 8 1.1 km | 2 500 m | 9 600 m | 10 625 m | 11 1.3 km | 13 1.3 km |
| <u>Boat (Salt) Unloading/Trucking Started Sept. 26, 1989</u> | | | | | | | | |
| Sept. 19 - Oct. 3/89 | Cl Na | 1800 410 | 420 320 | IS 210 | 17000 13000 | 280 240 | IS 490 | IS 200 |
| Oct. 3 - 17 | Cl Na | 120 140 | 280 270 | 120 140 | 210 380 | 260 270 | 280 560 | 120 200 |
| Oct. 17 - 31 | Cl Na | 2390 3700 | 6300 7300 | IS 160 | 430 360 | 5800 210 | 540 350 | 20 52 |
| Oct. 31 - Nov. 14 | Cl Na | 2200 1400 | 1100 780 | 100 140 | 1220 1100 | IS 410 | 700 550 | 700 320 |
| <u>Boat Unloading Stopped Nov. 3, 1989; Trucking Cont'd to Apr. 30, 1990</u> | | | | | | | | |
| Nov 14. - 29 | Cl Na | 140 210 | 340 290 | 660 470 | 670 670 | 280 310 | IS 340 | 780 610 |
| Nov. 29 - Dec. 12 | Cl Na | 4900 2800 | IS 3400 | 1700 820 | 2100 1200 | 620 460 | 480 390 | 380 2600 |

Moss Bag Concentrations of Chloride and Sodium Detected in the UTL Survey Area
 - Sept. 19, 1989 Through Apr. 3, 1990

| Exposure Period | Sites West of UTL | | | | | | Sites East of UTL | | | |
|---------------------|-------------------|--------------|-------------|--------------|--------------|---------------|-------------------|--------------|--------------|--------------|
| | 5 150 m | 12 150 m | 8 1.1 km | 2 500 m | 9 600 m | 10 625 m | 11 1.3 km | 12 1.3 km | 13 1.3 km | 14 1.3 km |
| Dec. 12 - 27 | Cl Na | 1500 890 | 640 470 | 1100 730 | 800 730 | 350 450 | 780 550 | 1300 900 | 1100 830 | |
| Dec. 27 - Jan. 9/90 | Cl Na | 3600 1800 | 1200 670 | 2400 1200 | IS 2700 | 460 340 | 360 200 | 3500 1800 | 3500 2200 | |
| Jan. 9 - 23 | Cl Na | 840 660 | 920 600 | 320 190 | 540 280 | 280 140 | IS 380 | 420 320 | 520 300 | |
| Jan. 23 - Feb. 6 | Cl Na | 1000 590 | 520 240 | 1000 260 | 700 530 | 52000 3700 | 3400 440 | 1200 800 | IS 330 | |
| Feb. 6 - 23 | Cl Na | 260 210 | 220 100 | 240 260 | 280 290 | 120 180 | 260 170 | 20 210 | 280 510 | |
| Feb. 23 - Mar. 6 | Cl Na | 2300 1300 | 600 520 | 900 690 | 1500 1000 | 600 520 | 540 540 | 1200 890 | 1400 850 | |
| Mar. 6 - 20 | Cl Na | 220 260 | 140 240 | 180 230 | 200 240 | 140 210 | 240 220 | 100 210 | 220 190 | |
| Mar. 20 - Apr. 3 | Cl Na | 120 150 | NS NS | 160 140 | 100 110 | 120 160 | 80 160 | 80 120 | 180 190 | |

* Approximate distance from UTL salt pad
 IS - insufficient sample NS - No sample received

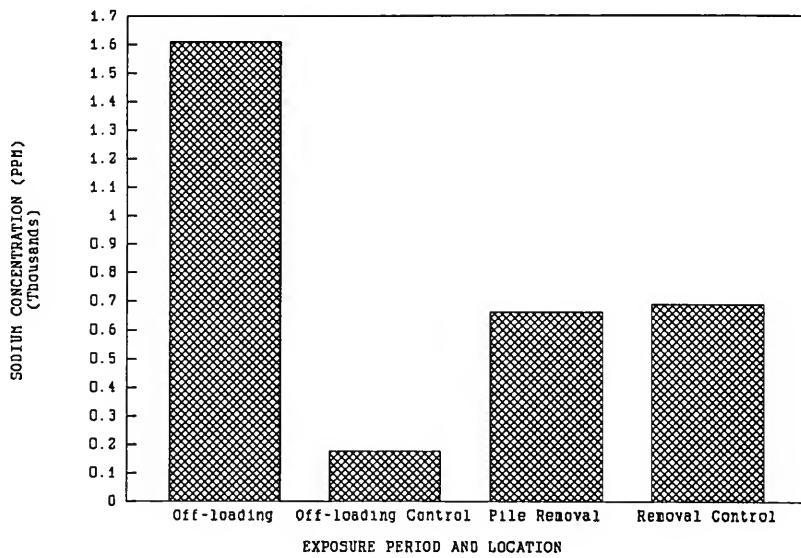


Figure 1 Moss Bag Sodium Means for Sites Close to UTL Versus Control Sites (8, 11 & 13) for Boat Off-Loading Exposures (Sept. 19 - Nov. 14/89) and for Salt Pile Removal Period (Nov. 14/89 - Apr. 3/90)

Figure 2: Approximate Moss Bag Locations In Relation to UTL Salt Storage Pad: 1986 - 1990

